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There was only one meeting of the Club after Hirst's death in February, 1892.

The second volume of the *Life* contains the following extracts (pages 126, 336) culled from Hooker's letters:

(1) To *Charles Darwin*, August 5, 1871: "I have been reading W. Thomson's[1] address [at the Edinburgh meeting of the British Association for the Advancement of Science in 1871], and am anxious to hear your opinion of it. What a belly-full it is, and how Scotchy! It seems to be very able indeed, and what a good notion it gives of the gigantic achievements of mathematicians and physicists—it really makes one giddy to read of them. I do not think that Huxley will thank him for his reference to him as a positive unbeliever in spontaneous generation—these mathematicians do not seem to me to distinguish between un-belief and a-belief—I know no other name for the state of mind that is traduced under the term scepticism. I had no idea before that pure mathematics had achieved such wonders in practical science, and I wonder how far Thomson's statements will be contested. The total absence of any allusion to Tyndall's labors, even when comets are his theme, seems strange to me."

(2) To *Rev. J. D. La Touche*, Dec. 24, 1893: "What you say of A, B, and C does not surprise me. They are 'ne plus ultra' mathematicians, have not a conception of biological science, and in fact are only *half intellects* (I suppose I deserve to be burned), but so it is, that I have often found such men to be impervious to reasoning out of their own circle, in matters of natural science. With biologists, who have to found everything, beyond pure observation, on circumstantial evidence, the case is quite different. For hundreds of biologists who are good mathematicians, you will not find ten vice versa."

ARTICLES IN CURRENT PERIODICALS.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY, volume 25, no. 7, April, 1919: "Mathematics in war perspective" by L. E. Dickson, 289–311 [Presidential address delivered before the American Mathematical Society, December 27, 1918]; "A partial isomorph of trigonometry" by E. T. Bell, 311–321; "The trains for the 36 groupless triad systems on 15 elements" by Louise D. Cummings, 321–324; "A theorem on areas" by T. Hayashi, 324–325; "Concerning the definition of a simple continuous arc" by G. H. Hallett, Jr., 325–326; "The transformation of a regular group into its conjoint" by J. E. McAtee, 326–329; "Notes" and "New publications," 329–336.—No. 8, May: "The life and services of Maxime Bôcher" by W. F. Osgood, 337–350; "A theorem on linear point sets" by H. Blumberg, 350–353; "A general form of Green's Theorem," 353-357; "Rotating cylinders and rectilinear vortices" by H. Bateman, 358–374; Review by A. Dresden of Shaw's *Lectures on Philosophy of Mathematics* (Chicago, 1918), 374–377; Review by R. D. Carmichael of Macrobert's *Functions of a complex variable* (London, 1917), 377–378; Review by A. Emch of Montessus de Ballore's *Lecons sur les fonctions elliptiques en vue de leurs applications* (Paris, 1917), 378–379; "Notes" and "New Publications," 379–384—No. 9, June: "The March meeting of the American Mathematical Society at Chicago," 385–392; "The April meeting of the San Francisco section, 393–397; "On a certain generation of rational circular and isotropic curves" by Arnold Emch, 397–404; "The self-dual plane rational quintic" by L. E. Wear, 405–408; "Groups containing a relatively large number of operators of order two" by G. A. Miller, 408–413; "The derivative of a functional" by P. J. Daniell, 414–416; Review by L. W. Dowling of *Scritti matematici offerti ad Enrico D'Ovidio*, etc. (Torino, 1918), 417–422; "Shorter Notices," 422–424; "Notes," 424–429; "New Publications," 429–432.

JOURNAL OF ACCOUNTANCY, New York, volume 27, 1919, January: "Practical interpolation" by A. S. Little, 48–60—April: "Rapid calculation of compound interest processes" by F. C. Belser, 241–248; "Mathematics of credit extension" by F. Thulin, 259–267.

JOURNAL OF EDUCATIONAL PSYCHOLOGY, Hershey, Pa., volume 10, no. 2, February, 1919: "English and mathematical abilities of a group of college students" by E. C. Tolman, 95–103. [Based on observations made on an introductory class in psychology at the University of California made up of sophomores, juniors and seniors (men and women)].

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[1] William Thomson (1824–1907), afterwards Lord Kelvin, was the son of James Thomson who became professor of mathematics at the University of Glasgow where William matriculated when he was a little more than ten years of age, and was afterwards to be for fifty-three years a "professor of Natural Philosophy."

JOURNAL OF PHILOSOPHY, PSYCHOLOGY AND SCIENTIFIC METHODS, volume 15, no. 10, May 9, 1918: "Doctrinal functions" by C. J. Keyser, 262–266. [Synopsis in *Mind*: Starts from Russell's notion of a propositional function which is neither true nor false until values have been assigned to its variables, and points out that values may always be given which make nonsense of the function and hence are to be called *inadmissible constants*. Admissible constants are divided into *verifiers* and *falsifiers*: the former "*satisfy* it and are called the *values* of its *variables*. Thus the values of a given function are the true propositions that are derivable from it by replacing its variables by admissible constants." Applying these distinctions to "the postulational method of founding and constructing mathematical sciences," it appears that as "any postulate-system contains one or more undefined terms and at least one of them denotes an *element*," which gives it the appearance of having a definite subject-matter, the system will require interpretation. In this process "the *rôle* of the undefined terms is the *rôle* of variables"; hence "a postulate system is not a system of propositions, as it is commonly said to be, but it is a system of propositional functions." It should be called therefore 'a doctrinal function,' and it is shown that "the number of values of any doctrinal function is equal to any given transfinite cardinal number. It is a corollary that "Hilbert's *Foundations of Geometry* is not a geometry at all, nor is it any other doctrine; it is a doctrinal function having an infinitude of values, some of them geometric, some of them algebraic, some of them neither one nor the other."]—No. 11, May 23: "The definition of infinity" by R. H. Dotterer, 294–301. [Synopsis in *Mind*: "Criticises the new 'infinity' of Dedekind and Cantor as doubly ambiguous. (1) Two infinite series do not stand *merely* in a one-to-one correspondence, but also in an infinity of others. But *unless* they do, the new definitions of 'similarity' and 'equality' break down. (2) The 'new infinite' is only the old in disguise, for that also involved an inexhaustible series and the possibility of a one-to-one correspondence (or of any other). Hence it retains also the old difficulties. Only they are hidden away in its definition. Thus the infinite series of cardinal numbers cannot be called a 'system' or a 'totality' without assuming a realised infinite. If 'totality' is defined to mean *determinable* only, the 'new infinite' cannot claim existence any more than the old. Hence it does not help in the solution of any of the problems of philosophy or theology."]—No. 14, July 4: "Mechanism and causality in physics" by M. P. Cohen, 365–386—No. 21, October 10: "A list of articles, mostly book reviews, contributed by Charles S. Peirce to *The Nation* to which is appended some additions to the bibliography of his published writings in this *Journal*, December 21, 1916," 578–584.

JOURNAL OF THE INDIAN MATHEMATICAL SOCIETY, volume 11, February, 1919: Frontispiece, Indian Mathematical Society, 2d Conference, January, 1919, Bombay; "Second Conference," 3–30; "Introductory Notes to differential geometry" by E. H. Neville, 30–33; "On the factorization of two large numbers" by N. B. Mitra, 34; Questions and Solutions, 37–40.

MATHEMATICAL GAZETTE, volume 9, March, 1919: "The Annual Meeting of the Mathematical Association—Report of the Council for 1918," 309–311; "Mathematics and the pivotal industries" by W. P. Milne, 312–316; "The teaching of geometry to first-year pupils" by B. A. Howard, 317–321; "Cubic graphs of the form $y = ax^3 + bx^2 + cx + d$" by A. Lodge, 322–326; Review by H. Hilton of Frost's *An Elementary Treatise on Curve Tracing* (London, 1918); [Quotation: "The reviser's hope that 'this edition will be found to be comparatively free from inaccuracies' unfortunately proves fallacious on a casual glance at the diagrams. Some errors, e. g. plate V., fig. 24, and VI. 17, are doubtless due to the printer. But III. 27; IV. 25, 26, 29 represent curves cut by a line in points whose number is greater than the curve's degree; while IV. 28 is also rather rough and ready. There is a tendency to draw cusps as though the tangents thereat were distinct, to exaggerate the rate of approach of a curve to its asymptote, and to misplace inflexions and their tangents. This is the more to be regretted, in that these are just the mistakes against which a beginner most needs warning"]. Review by W. P. Milne of Carey's *Infinitesimal Calculus* (London, 1917–18), 327–328; Review of Whitehead's *The Organization of Thought* (London, 1917), and Hermite's *Oeuvres*, tome 4, (Paris, 1917); "The Teacher's Library, "Section II, by W. P. Milne, i–v.

MEMOIRS OF THE NATIONAL ACADEMY OF SCIENCES, Washington, D. C., Volume 14, second memoir, 1919; "Complete classification of the triad systems on fifteen elements" by H. S. White, F. N. Cole, and Louise D. Cummings, 1–89: [Part 1: "Triad systems on 15 elements whose group is of order higher than unity" by H. S. White, 5–25; Part 2: "Trains for triad systems on 15 elements whose group is of order higher than unity" by L. D. Cummings, 27–68 (216 figures); Part 3: "Groupless triad systems on 15 elements" by H. S. White and L. D. Cummings, 69–72; Part 4: "Structure as defined by interlacings, heads, and semiheads; a complete census of triad systems in fifteen elements" by F. N. Cole, 73–80; Part 5: "Sequences and indices for all groupless triad systems on fifteen elements" by L. D. Cummings, 81–89.]

MONIST, volume 29, no. 2, April, 1919: "Pandiagonal magics of orders 6 and 10 with minimal numbers" by C. Planck, 307–316; "The publication of *Isis*" by G. Sarton, 318–319—[Reprinted from *Science,* February 14, 1919]; Review of *The philosophy of Mr. B*rtr*nd R*ss*ll, with an appendix of leading passages from certain other works.* Edited by P. E. B. Jourdain (London, Allen and Unwin, 1918), 319–320. [Quotation: ". . . No amount of quotation (finite by reason of editorial control) could exhaust the transfinite number of good things in this amusing volume. For the proof that this is not mere hyperbole I must refer the reader to the chapter on 'The Hierarchy of Jokes.' And when one comes delightedly across such gems of delicate irony as the logical analysis of Mr. Chesterton's method of disguising platitudes as paradoxes (p. 41) one can only hope that Mr. Jourdain will discover among the papers of the late Mr. R*ss*ll more, and still more, pin-prickings of popular bombastics."]

NIEUW ARCHIEF VOOR WISKUNDE, Amsterdam, series 2, volume 12, no. 4, 1918: "Nieuwe behandeling van een bekend kansvraagstuk" by F. Schuh, 361–373; "Remarque sur la singularité que présente la courbe nodale d'une surface développable quand l'arête de rebroussement possède une tangente double" by W. A. Versluys, 374–378; "Onderzoek van de functie die voor $R(z) > 0$ wordt voorgesteld door de reeks

$$\sum_{n=1}^{\infty} \left(\frac{n}{a}\right) \frac{e^{-nz}}{n^s}$$

by N. G. W. H. Beeger, 379–392; "Ueber gröszten gemeinsamen Teiler und kleinstes gemeinsames Vielfaches" by I. G. van der Corput, 393–404; "Constructie van de assen der ellips, die de centrale projectie is van een cirkel" by F. Schuh, 405–406; "Beweging van een materieel punt op den bodem eener draaiende vaas onder den invloed der zwaartekracht" by L. E. J. Brouwer, 407–419; "Elementair bewijs der intgebreide wederkeerigheidswet van Legendre" by A. L. Bartelds and F. Schuh, 420–438; "Addenda en corrigenda over de grondslagen der wiskunde" by L. E. J. Brouwer, 439–445; "On cylindrical functions" by L. Crijns, 446–449; "Over het differentieeren van bepaalde integralen" by J. Wolff, 450–453; "Eenige stellingen over limieten van integralen" by H. Bremekamp, 454–460; "Notes on some differential equations in physics and differential geometry" by T. Hayashi, 461–468; Review (in Dutch), 468–480.

NOTES AND QUERIES, London, 12th series, volume 5, February, 1919: "EULER ON THE END OF THE WORLD.—Euler the mathematician (1707–83) is said to have predicted that the end of the world would take place in a certain year. It is likely that some reference to the statements would be found in the letters of Catherine II (1729–96) to F. M. Grimm (1723–1807).

"Could a reader give some precise information?

R. G. H."

NOUVELLES ANNALES DE MATHEMATIQUES, volume 77, December, 1918: "Sur les troisième et quatrième centres de courbure des courbes de Cesàro" by R. Goormaghtigh, 441–445; "Sur un problème concernant des groupes de points sur l'hyperbole équilatère" by R. Goormaghtigh, 445–448; "Sur les nombres complexes de deuxième et de troisème espèce" by L. G. Du Pasquier, 448–461; "Propriété de certaines courbes et surfaces enveloppes" by M. Weill, 462–464; "Sur les cercles bitangents a la parabole" by J. Bouchary, 464–471; "Sur les courbes définies par une relation entre les distances de chacune de leurs tangentes à des points fixes" by M. d'Ocagne, 471–472.

PROCEEDINGS OF THE LONDON MATHEMATICAL SOCIETY, series 2, volume 17, part 5, March, 1919: "Professor Olaus Henrici" by M. J. M. Hill, xlii–xlix. [Quotations: "Olaus Magnus Friedrich Erdmann Henrici was born in the year 1840, in Meldorf, on the West Coast of Holstein, where his father held a post in the Danish Civil Service. His father had studied Science and Engineering at the Gewerbschule in Berlin, which afterwards became the College at Charlottenburg, and he was one of the three who prepared the plans for the canal from Kiel to the mouth of the Elbe . . . Henrici will be remembered chiefly as a great teacher. During his years of struggle [1865–1869; he went to London in 1865] when he was obliged to spend much time in giving lessons in elementary mathematics to school boys, he had learned to probe the working of the minds of his pupils. This was of great value to him in his subsequent career as a teacher and a writer, for he acquired the faculty of expressing himself with great clearness in both capacities. He published nothing until he felt completely satisfied as to its form. But for this characteristic more of his methods and ideas would have been preserved. I understand that he has left a large amount of manuscript, and it is much to be hoped that some one will be found to go through it with extreme care."]

School Science and Mathematics, volume 19, no. 5, May, 1919: "Construction work in solid geometry" by E. W. Schreiber, 407–413; "Historical notes in the mathematical text-books" by G. A. Miller, 414–416; "Graphical algebra" by F. E. Nipher, 417–420; "History of mathematics at University of California" by O. Schmiedel, 462; [Quotation: "Three courses are given the first term of the present session; a largely attended course on the History of Mathematics and Physics, a course on The Teaching of Mathematics in Secondary Schools, and a most interesting seminar course on The History of Fundamental Concepts of the Calculus and of Fluxions."] "Useful benefits from study of mathematical history" by O. Schmiedel, 463; Problems and solutions, 468–473.

Science Progress, volume 13, No. 3, January, 1919: Mr. Oscar S. Adams has called attention to the fact that, in quoting from R. Ross's article on isosceles trigonometry in our April issue, two misprints occur: (1) *for* "$(\text{bas}\ s\theta + i\ \text{bas}\ \theta)^n = \text{bas}\ sn\theta + i\ \text{bas}\ n\theta$" *read*

$$\text{``}(\text{bas}\ s\theta + i\ \text{bas}\ \theta)^n = 2^{n-1}(\text{bas}\ sn\theta + i\ \text{bas}\ n\theta)\text{''};$$

(2) *for* "between θ and π" *read* "between 0 and π." The first of these slips was due to an error in the original. Mr. Adams remarks further: "De Moivre's theorem can of course apply only to complex numbers that lie on the unit circle with the origin as center or, in other words, to those with modulus equal to unity. $\text{bas}\ s\theta + i\ \text{bas}\ \theta$ lies on the circle with radius equal to two"—No. 4, April: "The discovery of the Calculus" by R. R., 634–635; "Mathematics in an encyclopædia" by P. E. B. Jourdain, 648–651; [First paragraph: "A discussion of the nature and extent of articles in a proposed mathematical dictionary has lately excited a good deal of interest in America. The Mathematical Association of America has appointed a committee to investigate the subject, and Dr. G. A. Miller (Amer. Math. Monthly, 1918, *25*, 383–7; cf. 428) has given an example of a proposed article dealing with the theory of groups. This article has the conventional characteristics of an article for a dictionary. This is not meant to imply that the article is not a good one of its kind: it is, in fact, a very thorough and exhaustive treatment of the things about which it means to give information. But it seems to me that what it and most other dictionary articles discuss is exactly what nobody really wants who is not bent on acquiring merely the sort of knowledge that is required by examinations. Nearly all of Dr. Miller's specimen article is devoted to definitions of "groups" in the general technical meaning of the word, and particular qualities of groups. It is no uncommon thing to read in an examination paper such a question as: 'Define the terms *isomorphism* and *transitivity*;' but such information, at least in this form, is not required outside the examination room. Surely an intelligent being who consults an article on a science in an encyclopædia does so from a wish to know what such-and-such a department of knowledge is about and what has been done in it, whether he does so for cultivating his own mind, or as a preliminary for cultivating the minds of others, or for his own work of discovery. He does not want simply to fill his memory with what certain words mean in the technical language of the present: his aim would be to get a firm grasp of the principles underlying that particular subject, and to find out why certain notions were so important as to be fixed by a name—such as "isomorphism," for instance. It is not the formal *definitions* that we must seek in the first place; it is those more or less vague ideas which have lost part of their vagueness so as to become apparently definable. Of course we can never be quite certain that the definitions we may arrive at in some science at a particular time are quite free from vagueness: a mathematician who is interested in the principles of his subject can find many instances of 'definitions' which were seriously given only a few years ago and which can now be seen not to define at all. The theory that definitions should form the subject-matter of articles in a dictionary or encyclopædia, and a great part of the subject matter of text-books, is a theory held by those schoolmasters who think that examinations are the goal of knowledge; and we must always remember that professors are only a better class of schoolmasters." In the remainder of the article Mr. Jourdain deals chiefly with the mathematical articles in the *Encyclopædia Britannica.*] "The general theory of relativity and Einstein's theory of gravitation" by G. W. Tunzelman, 652–657—[Reprinted in *Scientific American Supplement,* May 31, 1919, Vol 87, pp. 346–347]; Reviews by P. E. B. Jourdain of Bateman's *Differential equations* (London, 1918), Veblen and Young's *Projective Geometry* (Boston, 1910–1918), Vollenhoven's *De Wijsbegeerte der Wiskunde van Thëistisch Standpunt* (Amsterdam, 1918) and Tuttle's *The Theory of Measurements* (Philadelphia, 1916), 666–672; Review by A. E. Heath of Jourdain's *The Philosophy of Mr. B*rtr*nd R*ss*ll with an appendix of leading passages from certain other works* (London. 1918), 670–671; Review by H. S. J[ones] of Kaye's *The Astronomical Observatories of Jai Singh*

(Calcutta, 1918), 672–674; Review by E. H. B. of C. V. Raman's *On the mechanical theory of the vibrations of bowed strings and of musical instruments of the violin family, with experimental verification of the results*, Part I (Calcutta, 1918), 683. [Quotations: "Helmholtz on an experimental basis was able to construct a partial theory of the bowed string. F. Krigar Menzel and A. Raps photographed, upon a revolving drum carrying a film, various points of bowed strings so as to exhibit their displacement-time graphs. E. H. Barton and his pupils took simultaneous photographs of the behaviour of the strings and either bridge, belly or air of a monochord or violin. But in none of the foregoing cases was a direct mechanical theory of the string, bridge, etc., attempted. This is now done by C. V. Raman.

"The equations of motion of the string are written and solved for the case of a periodic force applied transversely by the bow at any given position. The equations of motion of the bridge are next written and dealt with. The *modus operandi* of the bow is afterwards examined and a simplified kinematical theory of the bowed string is based upon it. . . . Another interesting subject here treated is that of the effect of the *mute*, which, by loading the bridge, enfeebles and veils the tone of the instrument. . . . This work contains twenty-eight figures in the text and twenty-six excellent full-page photographic reproductions, and well deserves the careful attention of those interested in such a notable contribution to an important subject."]

SCIENTIA, volume 84, April, 1919: "Synthèses et visions d'histoire de la science" by A. Mieli, 310–313; [Discussion of topic with special reference to three works: S. Günther, *Geschichte der Naturwissenschaften*, 2 little volumes, Leipzig, Reclam; F. Dannemann, *Die Naturwissenschaften in ihrer Entwickelung und ihrem Zusammenhang*, 4 volumes, 1910–1913; and W. Libby, *An Introduction to the History of Science*, New York, 1918.] Review by G. Scorza of Borel's *Introduction géométrique à quelques théories physiques* (Paris, 1914) and Borel's *Leçons sur les fonctions monogènes uniformes d'une variable complexe* (Paris, 1917), 314–316; Review by R. Marcolongo of Whittaker's *A Treatise on the analytical dynamics of particles and rigid bodies* (Cambridge, 1917).

SCIENTIFIC AMERICAN SUPPLEMENT, volume 87, April 5, 1919: "A scientific coin problem. How some mysterious numerical effects can be produced" by T. L. De Land, 220.

TEXAS MATHEMATICS TEACHER'S BULLETIN, volume 4, no. 3, May, 1919: "Summer school courses in mathematics," 3–6; "Number systems and numerals" by Phillis Henry, 7–10; "Saving time and gaining efficiency in teaching trigonometry" by Goldie P. Horton, 11–14; "A few facts about mathematics" by P. M. Batchelder, 15–17; "Bibliography of the teaching of mathematics" by C. D. Rice, 18–20; "Methods *vs.* results and mathematical induction" by A. A. Bennett, 21–28; "A trigonometric solution of the irreducible case of the cubic equation with applications" by C. E. Brand, 29–34; "Checking the solution of an equation" and "Familiar tricks based on literal arithmetic," 35–38—[Reprinted from W. F. White's *A Scrap Book of Elementary Mathematics*]; "The Pentagram during 1918–1919" by Goldie P. Horton, 39–40; "The straight edge," 41.

TÔHOKU MATHEMATICAL JOURNAL, volume 15, nos. 1–2, March, 1919: "On a determinate system of non-independent trials" by M. Watanabe, 1–134; "Sur l'équation $x_1^5 + x_2^5 + x_3^5 + \cdots + x_k^5 = 0$" by A. Filippov, 135–145; "On closed curves described by a spherical pendulum" by A. Emch, 146–165; "On a transformation theorem relating to spheroidal harmonics" by B. Datta, 166–171; "On certain mean curves defined by the series of orthogonal functions" by K. Ogura, 172–180; "A remark on the dynamical system with two degrees of freedom" by K. Ogura, 181–183; "A contribution to the question of linear dependence in linear integral equations" by L. J. Rouse, 184–216.

ZEITSCHRIFT FUR MATHEMATISCHEN UND NATURWISSENSCHAFTLICHEN UNTERRICHT ALLER SCHULGATTUNGEN, volume 49, no. 12, December, 1918: "Die Entwicklung des Satzes vom vollständigen Vierseit und Viereck zu einem Grundpfeiler des natürlichen Systems der Geometrie" by W. Dieck, 329–341; "Über die Anwendung beweglicher Figuren im geometrischen Unterricht" by Elisabeth K. Staiger, 341–348; Reviews of Neuendorff's *Praktische Mathematik*, 2. Teil (Leipzig, 1918), and of Seyffarth's *Elementarmathematik zum Gebrauch an Lehrerbildungsanstalten*, 1. Teil: Allgemeine Arithmetik und Algebra, 5. Auflage (Dresden–Blasewitz, 1917).

AMERICAN DOCTORAL DISSERTATIONS.

Gillie A. Larew, *Necessary conditions in the problems of Mayer in the calculus of variations*. Pp. 1–22. [Reprinted from *Transactions of the American Mathematical Society*, 1919.] (Chicago, 1916.)

A. S. Merrill, *An isoperimetric problem with variable end-points*. Pp. 60–78. [Reprinted from *American Journal of Mathematics*, 1919.] (Chicago, 1916.)